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PROMOTING BROADBAND COMPETITION

An Analysis of Broadband Network Unbundling Policies and CLEC Broadband Competition

Working Paper

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This paper analyzes the costs incurred by CLECs when leasing ILEC facilities (UNEs, collocation, special access circuits, etc.) to demonstrate that the FCC's Broadband Forbearance orders have impeded the ability of CLECs to compete for broadband services. Our results corroborate the *Berkman Study*'s findings that open access policies would better promote the availability and affordability of broadband services.

This paper was prepared by QSI Consulting, Inc., on behalf of Covad Communications, Inc.

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I. INTRODUCTION

a. Purpose

The purpose of this paper is to contribute to the Federal Communications Commission's ("FCC's") on-going formulation of an appropriate National Broadband Plan[1] and to respond to its specific request for comments regarding the Section 706 Notice of Inquiry ("NOI")[2] and the recent broadband study[3] conducted by Harvard's Berkman Center for Internet and Society study ("*Berkman Study*").[4]

The *Berkman Study* is based on a careful examination of broadband developments and policies in some thirty member countries of the Organization for Co-Operation and Economic Development ("OECD"). Among a number of other objectives, the *Berkman Study* evaluates the impact of making incumbent carriers' broadband networks open to use by their competitors, wherein such "open access" may encompass unbundling, bitstream access, collocation requirements, wholesaling, and/or functional separation.[5] Based on its cross-country analysis, the *Berkman Study* finds a positive linkage between adoption of open access policies on the one hand and greater availability, affordability, and capacity of broadband services on the other, as open access expands competitive supply and innovation.[6]

However, the *Berkman Study* also observes that there is a tension between the benefits it attributes to open access policies and a competing theory, which maintains "that forcing incumbents to lease their network to competitors will undermine that industry's incentives to invest in higher capacity networks to begin with, and without that investment, the desired outcomes will not materialize."[7] As the *Berkman Study* notes (and we explain in greater detail below), the FCC initially adopted certain open access policies with respect to broadband services during implementation of the 1996 *Telecom-*

[1] FCC GN Docket No. 09-51, *A National Broadband Plan for Our Future.*

[2] FCC-09-65 *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, Notice of Inquiry, July 2009.

[3] *http://www.fcc.gov/stage/pdf/Berkman_Center_Broadband_Study_13Oct09.pdf.*

[4] *Comments Sought on Broadband Study Conducted by the Berkman Center for Internet and Society*, NBP Public Notice # 13, Pleading Cycle Established, GN Docket Nos. 09-47, 09-51, 09-137.

[5] *Berkman Study* at 11.

[6] *Id. at* 12 and Chapter 4.

[7] *Id. at* 12.

munications Act, but subsequently adopted the latter theory in the early years of this decade, and began to progressively close off competitors' access to incumbent broadband networks. [8]

The *Berkman Study* concludes that as this policy shift took hold, the United States' international ranking in terms of broadband availability and affordability began to slip from the top-tier position it had held at the turn of the decade, relegating the U.S. to a "middle-of-the-pack performer on most first generation broadband measures" today as other countries catch and surpass it.[9]

The *Berkman Study* establishes the linkage between open access to broadband networks and broadband availability and affordability by means of *cross-country data comparisons,* comparing such observables as prices and penetration levels and correlating them with national broadband policies. In this paper, we supplement that analysis by providing several detailed, business case-oriented analyses. Our central focus is on how the FCC's broadband policies to date have restricted new entrants' ability to lease incumbent local exchange carriers' ("ILECs'") network facilities and, in doing so, have forced new entrants into more expensive network configurations. Specifically, we will examine how quickly new entrants' costs escalate for competitive broadband deployment under varying assumptions regarding the extent new entrants are allowed access to the ILECs' broadband networks.

The next section of our paper provides an overview of the analyses we have undertaken and our preliminary findings.

b. Overview and Summary of Findings

Our analyses focus on the costs that competitive local exchange carriers ("CLECs") would incur under three scenarios in which CLECs lease ILEC facilities (UNEs, collocation, special access circuits, etc.) in order to offer broadband services. The three scenarios are the following:

- "Homerun" copper, i.e. the ILEC's loop facilities are provisioned entirely on copper wire pairs from the customer premises back to the serving central office ("CO");
- Various combinations of fiber feeder/copper terminus, including traditional IDLC systems and more advanced deployments such as AT&T's U-verse network; and
- All-fiber loops, e.g. Verizon's fiber-to-the-home ("FTTH") architecture FiOS network.

We consider these scenarios at a sample of five different Metropolitan Statistical Areas ("MSAs"):[10] *Los Angeles, New York, Philadelphia, Phoenix and Washington, D.C.* These five MSAs are important markets for most CLECs and include serving territories of all three Regional Bell Operating Companies ("RBOCS"), i.e. AT&T, Verizon and Qwest. As will be discussed, the limitations on CLECs' ability to compete more

[8] *Id. at* 12.

[9] *Id. at* 10.

[10] Special access pricing varies by MSAs.

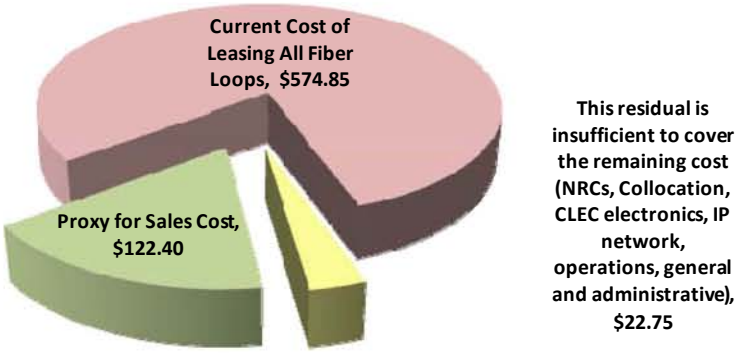
broadly stem from two interrelated factors: escalating costs (as more complex configurations have to be purchased at higher or non-UNE based prices) and/or limited availability of facilities.

While our study examines a variety of situations, the chart below, reflecting results from our calculations for lowest-cost zones,[11] shows a price squeeze faced by CLECs in the aforementioned five MSAs when they need to serve business customers in locations where copper loops are either not available or not available in the necessary numbers of wire pairs to maintain service speeds over larger distances.

Example of Price Squeeze in All-Fiber Loop Scenario in the Lowest-Cost Zone

Retail Rate for 5 Mbps Service: $720/month

Cost of Leasing Fiber: Average of Lowest Zone Rates in 5 MSAs



The above results are representative of the general results we calculate for a larger set of situations, many of which place CLECs in yet more severe price squeezes than depicted in the above chart. The essence of our analysis is that new entrants' lack of access to the incumbents' broadband facilities and services (fiber and/or bit streams) forces new entrants into costlier configurations (with remote terminal collocations, special access circuits, etc.), thus artificially limiting their ability to compete.

Our results for the five MSAs consistently show a price-squeeze where home run copper loops either are entirely not available, or are available only in limited numbers and at shorter distances. In these scenarios, the results imply that the CLECs that are dependent on ILEC "last-mile" distribution facilities are effectively foreclosed from widespread provision of competitive broadband services under the FCC's existing "closed" approach to ILEC broadband networks. As such, our results corroborate the *Berkman Study*'s conclusions concerning the central role of open access policies, and demonstrate that adopting open access policies would stimulate competition and increase the availability and affordability of broadband in the United States.

[11] ILEC UNE and special access rates often vary across density zones or other factors, such as wire center characteristics.

In light of our findings, we conclude that the promotion of broadband competition in the United States will be greatly advanced if the FCC takes affirmative steps to (1) guarantee continued access to the ILECs' legacy copper networks and (2) expands CLEC opportunities for access to include portions of the ILECs' emerging fiber-based broadband networks, both in terms of facilities and bit streams.

II. BRIEF OVERVIEW OF THE FCC'S BROADBAND FORBEARANCE POLICIES AND THEIR IMPACT ON CLECS

a. ILEC Unbundling and the Line Sharing Regime

When the landmark *Telecommunications Act of 1996* was passed,[12] it promised to usher in a new era of telecommunications competition in the U.S., founded in part on applying open access principles to the ILECs' local exchange networks. Three years later, the FCC established a significant new unbundling requirement, "line sharing," to facilitate competitive provision of DSL services for Internet access.[13] Once the FCC established its line sharing regime, CLECs such as Covad made rapid gains in the Internet access services marketplace, increasing the range of broadband service options available to mass-market residential and business customers and putting competitive pressure on the ILECs to follow suit. In January 2001, the FCC issued a reconsideration order that reaffirmed its commitment to line sharing as a vehicle to support competitive provision of Internet access services.[14]

b. Court Reversals and the Triennial Review

However, the progress of broadband unbundling in the U.S. was soon to change, as the ILECs' concerted legal challenges to the FCC's unbundling rules began to succeed. The judicial review of the *Local Competition Order* and related FCC unbundling rules is a complex story that is well beyond the scope of this paper. Most relevant here is that, after a series of federal circuit court rulings and appeals that

[12] Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 ("the *Act*").

[13] *Deployment of Wireline Services Offering Telecommunications Capability and Implementation of the Local Competition Provisions of the Telecommunications Act of 1996*, Third Report and Order in CC Docket No. 98- 147, Fourth Report and Order in CC Docket No. 96-98, 14 FCC Rcd 20912 (1999) (*Line Sharing Order*). "Line sharing" refers to unbundling the high-frequency portion of the local loop's transmission bandwidth from the low-frequency voice band, and making it available to support competitors' Digital Subscriber Line ("DSL") services.

[14] *Deployment of Wireline Services Offering Advanced Telecommunications Capability and Implementation of the Local Competition Provisions of the Telecommunications Act of 1996,* CC Docket Nos. 98-147 and 96-98, Third Report And Order on Reconsideration in CC Docket No. 98-147, Fourth Report and Order on Reconsideration in CC Docket No. 96-98, et al (*Line Sharing Reconsideration Order*).

ultimately resulted in review by the Supreme Court,[15] much of the FCC's implementation of the Act's Section 251 unbundling requirements survived, but the FCC had to revisit the conditions under which unbundled access could be considered sufficiently "necessary" to undertake.

The *UNE Remand Order* that the FCC issued in response to the Supreme Court *Iowa Utilities Board* decision reinterpreted the Act's unbundling requirements to place them "within the larger statutory framework of the 1996 Act,"[16] including "the extent to which the unbundling obligations we adopt will encourage the development of facilities-based competition by competitive LECs, and innovation and investment by both incumbent LECs and competitive LECs, especially for the provision of advanced services."[17] Foreshadowing its subsequent change in course, the FCC declined to require ILECs to unbundle their packet switching capabilities, after concluding that such unbundling might reduce ILEC investments in broadband infrastructure and thus conflict with "our overriding objective, consistent with the congressional directive in section 706 [of the *Telecommunications Act*] …to ensure that advanced services are deployed on a timely basis to all Americans." The *UNE Remand Order* also committed the FCC to a full review of its unbundling policy and rules in three years' time.

The "triennial review" proceeding spanning 2001-2003 proved to be highly contentious, and brought into open view deep divisions within the FCC concerning the future of its unbundling initiatives. By the time that the *Triennial Review Order* was released in August 2003, the FCC's majority opinion placed a strong emphasis on Section 706 and a heavy reliance on intermodal, facilities-based competition, principally from cable systems and wireless services, as the chief means to spur deployment of broadband-based advanced services. Intramodal competition, i.e. competitive entry based on unbundled access to ILEC networks, took a backseat, with high priority afforded to ensuring that unbundling requirements would not reduce ILECs' economic incentives to deploy their own broadband facilities. Thus the *Triennial Review Order* significantly curtailed competitive access to the ILECs' facilities for broadband services, finding that ILECs did not have Section 251 obligations to unbundle: (1) fiber-to-the-home ("FTTH"), or more generally FTTx[18] loops in "greenfield" (new deployment) situations; (2) the broadband capabilities of FTTH loops built as overbuilds to existing voice loops,; or (3) their packet-switching capabilities, including those of hybrid fiber-copper ("HFC") loops.[19] The *Triennial*

[15] *AT&T v. Iowa Utils. Bd.*, 119 S. Ct. 721, 734-36 (1999) (*Iowa Utils. Bd.*). A second Supreme Court ruling in 2002, *Verizon*, 535 U.S. 467, upheld the FCC's "TELRIC" rules for determining cost-based rates for unbundled network elements (UNEs).

[16] *Implementation of the Local Competition Provisions of the Telecommunications Act of 1996*, CC Docket No. 96-98, Third Report and Order and Fourth Further Notice of Proposed Rulemaking, 15 FCC Rcd 3696, 3699, (1999) (*UNE Remand Order*), at para. 2.

[17] *Id.*, at para. 15.

[18] In FTTx, the "x" stands for various possible locations, such as the remote terminal, curb, premises, home.

[19] *Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers, Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, Deployment of Wireline Services Offering Advanced*

Review Order also declined to reinstitute line sharing, after the D.C. Circuit Court had vacated the *Line Sharing Order* in September 2002.[20]

In 2004, the FCC issued follow-up decisions to the *Triennial Review Order* that scaled back its broadband-related unbundling requirements even further. The FCC first eliminated unbundling for ILEC fiber facilities to apartment buildings and other multiple dwelling units ("MDUs") in its *MDU Reconsideration Order.*[21] It then eliminated unbundling for ILEC fiber-to-the-curb ("FTTC") loops.[22]

c. Regulatory Forbearance and Continued Retreat from Broadband Unbundling

The same year, the FCC began applying a new vehicle, regulatory forbearance,[23] to further reduce the ILECs' broadband unbundling obligations, notably those of the Bell Operating Companies ("BOCs"). In the *Section 271 Broadband Unbundling Order*, the FCC granted the BOCs' petitions to forbear from the Section 271 obligations that had specifically applied to the BOCs relative to broadband unbundling, thereby curtailing competitive access to the same degree as the *Triennial Review Order* had for ILECs generally.[24] In December 2004, Verizon petitioned the FCC for a grant of forbearance from certain long-

Telecommunications Capability, CC Docket Nos. 01-338, 96-98, 98-147, Report and Order and Order on Remand and Further Notice of Proposed Rulemaking, 18 FCC Rcd 16978 (2003) (*Triennial Review Order*), at paras. 272-295.

[20] See *USTA v. FCC*, No. 00-1012, Order (D.C. Cir. Sept. 4, 2002) (USTA, 290 F.3d 415). The D.C. Circuit Court subsequently vacated and remanded portions of the *Triennial Review Order*, but the resulting FCC order on remand did not address issues directly related to broadband open access. See *United States Telecom Ass'n v. FCC*, 359 F.3d 554, 564-93 (D.C. Cir. 2004) (*USTA II*), *cert. denied*, 543 U.S. 925 (2004), *on remand*, *Unbundled Access to Network Elements, Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers*, WC Docket No. 04-313, CC Docket No. 01-338, Order on Remand, 20 FCC Rcd 2533, 2541, para. 12 (2004) (*Triennial Review Remand Order*).

[21] *Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers, Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, Deployment of Wireline Services Offering Advanced Telecommunications Capability*, CC Docket Nos. 01-338, 96-98, 98-147, Order on Reconsideration, FCC 04-191 (rel. Aug. 9, 2004) (*MDU Reconsideration Order*).

[22] *Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers; Implementation of the Local Competition Provisions of the Telecommunications Act of 1996; Deployment of Wireline Services Offering Advanced Telecommunications Capability*, CC Docket Nos. 01-338, 96-98, 98-147, Order on Reconsideration, FCC 04-248 (rel. Oct. 14, 2004), 19 FCC Rcd 20293 (*FTTC Reconsideration Order*). Therein, the FCC defined "an FTTC loop" as a fiber facility connecting to copper distribution plant that is 500 feet or less from the customer's premises. See *id.* at para. 10.

[23] Forbearance refers to the FCC's ability pursuant to Section 10 of the Act to refrain from applying particular regulations under certain specified conditions.

[24] *Petition for Forbearance of the Verizon Telephone Companies Pursuant to 47 U.S.C. § 160(c); SBC Communications Inc.'s Petition for Forbearance Under 47 U.S.C. § 160(c); Qwest Communications International Inc. Petition for Forbearance Under 47 U.S.C. § 160(c); BellSouth Telecommunications, Inc. Petition for Forbearance Under 47 U.S.C. § 160(c)*, WC Docket Nos. 01-338, 03-235, 03-260, 04-48, Memorandum Opinion and Order, 19 FCC Rcd 21496 (2004) (*Section 271 Broadband Forbearance Order*), aff'd, EarthLink, Inc. v. FCC, 462 F.3d 1 (D.C. Cir. 2006) (EarthLink v. FCC).

standing regulatory requirements to the extent they applied to its broadband services.[25] The FCC took no action on Verizon's petition, and by operation of law (which prescribed that such a petition would be granted after a certain time period if the FCC did not make a ruling by that time) it was granted in March 2006.[26] Subsequently other major ILECs sought similar forbearance for their broadband services, which the FCC granted to AT&T (along with the legacy BellSouth operating companies),[27] and then to the ILECs Embarq, Frontier, and Citizens, all in the same month (October 2007).[28] In these decisions, the FCC granted forbearance from dominant carrier regulation, tariffing and cost support requirements, and certain *Computer Inquiry* regulations for those ILECs' existing packet switching and optical (i.e., non-TDM) broadband transmission services, but it declined to remove them from Title II regulation (i.e., classification as "telecommunications services") and associated common carriage requirements.[29]

However, in a separate decision released in September 2005, the FCC did remove from Title II regulation and *Computer Inquiry* requirements all facilities-based broadband Internet access services offered by ILECs and other wireline carriers, reclassifying those services as "information services,"[30] to put them on par with its prior decision to classify cable modem service in the same manner.[31] A key consequence of this order is that "[f]acilities-based wireline broadband Internet access service providers are no longer

[25] *Petition of the Verizon Telephone Companies for Forbearance*, WC Docket No. 04-440 (filed Dec. 20, 2004) (*Verizon Forbearance Petition*). The *Verizon Forbearance Petition* sought forbearance from Title II of the Communications Act of 1934 and the Commission's *Computer Inquiry II* rules as they pertained to its broadband services.

[26] "Verizon Telephone Companies' Petition for Forbearance from Title II and Computer Inquiry Rules with Respect to their Broadband Services Is Granted by Operation of Law," WC Docket No. 04-440, News Release (rel. Mar. 20, 2006).

[27] *Petition of AT&T Inc. for Forbearance Under 47 U.S.C. § 160(c) from Title II and Computer Inquiry Rules with Respect to Its Broadband Services; Petition of BellSouth Corporation for Forbearance Under Section 47 U.S.C. § 160(c) from Title II and Computer Inquiry Rules with Respect to Its Broadband Services*, WC Docket No. 06-125, Memorandum Opinion and Order, FCC 07-180 (rel. Oct. 12, 2007) (*AT&T Title II and Computer Inquiry Forbearance Order*) *pets. for review pending*, Nos. 07-1426, 07-1427, 07-1429, 07-1430, 07-1431, and 07-1432 (D.C. Cir. filed Oct. 22, 2007).

[28] *Petition of the Embarq Local Operating Companies for Forbearance Under 47 U.S.C. § 160(c) from Application of Computer Inquiry and Certain Title II Common-Carriage Requirements; Petition of the Frontier and Citizens ILECs for Forbearance Under Section 47 U.S.C. § 160(c) from Title II and Computer Inquiry Rules with Respect to Their Broadband Services*, WC Docket No. 06-147, Memorandum Opinion and Order, FCC 07-184 (rel. Oct. 24, 2007) (*Embarq-Frontier-Citizens Title II and Computer Inquiry Forbearance Order*).

[29] See, e.g., *AT&T Title II and Computer Inquiry Forbearance Order* at para. 12 (forbearance scope), paras. 53-58 (Computer Inquiry forbearance), and para. 67 (Title II retention).

[30] *Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, CC Docket No. 02-33, Report and Order and Notice of Proposed Rulemaking, 20 FCC Rcd 14853 (2005) (*Wireline Broadband Internet Access Services Order*), aff'd, Time Warner Telecom v. FCC, No. 05-4769 (and consolidated cases) (3rd Cir. Oct. 16, 2007) (Time Warner Telecom v. FCC).

[31] The FCC had issued a Declaratory Ruling that cable modem service was an information service in March 2002, but it took another three years before related legal challenges were resolved by the Supreme Court. See *National Cable & Telecommunications Ass'n v. Brand X Internet Services*, 125 S. Ct. 2688 (2005) *(NCTA v. Brand X), aff'g Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities, Internet Over Cable Declaratory Ruling, Appropriate Regulatory Treatment for Broadband Access to the Internet Over Cable Facilities*, GN Docket No. 00-185 & CS Docket No. 02-52, Declaratory Ruling and Notice of Proposed Rulemaking, 17 FCC Rcd 4798 (2002) (*Cable Modem Declaratory Ruling and NPRM*).

required to separate out and offer the wireline broadband transmission component (i.e., transmission in excess of 200 kilobits per second (kbps) in at least one direction) of wireline broadband Internet access services as a stand-alone telecommunications service under Title II…"[32]

When this series of FCC decisions from the *Triennial Review Order* onward are considered in combination, it is clear that at this point the CLECs have largely been closed off from the ILECs' broadband network capabilities, both in terms of access to facilities and to bit streams, with the exception of copper loops.

d. CLEC Use of the ILECs' Copper Infrastructure for Provision of Competitive Broadband Services

As the FCC eliminated competitive access to more and more broadband-related capabilities and functions of the ILEC networks, CLECs wishing to leverage the ILEC networks to provide competitive broadband services focused on the ILEC infrastructure that continued to be available, particularly the ILECs' copper local distribution facilities. As business customers increasingly turn to Ethernet-based communications services to link their Ethernet local area networks ("LANs"),[33] CLECs have been responding by developing broadband offerings based on Ethernet Over Copper ("EoC"), Ethernet Over DS1, and Ethernet Over BSDSL technologies. Bonding multiple copper loops into a single high-capacity data path has permitted CLECs to offer so-called "Mid-Band" EoC services with symmetrical (i.e., the same upload and download) speeds in the 2 to 10 Mbps range and higher. These services are being marketed to small and medium business customers, filling in a significant gap in the offerings of the ILECs and cable systems, between the less-expensive, but lower-speed/less-reliable mass-market oriented DSL and cable modem services at the low end, and the very expensive, guaranteed bandwidth DS3-based and Metro Ethernet services offered to large business customers under Service Level Agreements, at the high end. While, according to the *Berkman Study*, the United States performs well in the availability and affordability of lower bit rate broadband services, it is the lack of available alternatives and competitive pressures that cause us to underperform relative to other OECD countries in the medium and higher bit rate services.

Critical as the EoC strategy may be for CLECs in offering broadband services, CLECs continue to face several obstacles. First, as the ILECs continue their efforts to push their fiber deployments out closer to end users, via fiber-to-the-curb ("FTTC") and FTTP architectures, they have reduced the availability of

[32] *Broadband Internet Access Services Order*, at para. 5. The FCC had established a one-year transition period, now expired, before fully implementing this provision.

[33] See, e.g., Infonetics Research, "Ethernet and IP MPLS VPN services growing in the face of downturn," August 4, 2009 (downloaded from http://www.infonetics.com/pr/2009/Ethernet-IP-MPLS-VPN-Services-Market-Research-Highlights.asp on 11/11/09).

copper loops running back to the central office.[34] Although the distribution portions of those loops may remain on copper and in theory could be purchased on an unbundled basis, the economic reality is that accessing them at the ILECs' remote terminals ("RTs") is almost always economically infeasible, because the high costs of collocating the CLECs' DSLAMs at the RT (as well as the transport required from the RT) cannot be spread across a sufficiently large customer base, in contrast to what can be achieved at the higher level of aggregation occurring upstream at the ILEC central office. Moreover, CLECs that opt to pursue EoC strategies rely on the ILECs' copper facilities and, just as importantly, regulatory protections to bar the ILECs from unilaterally retiring their copper loop plant, for which ILECs may have ample incentive as they upgrade to fiber

III. ANALYSIS OF CLEC WHOLESALE COSTS

In order to compete effectively in broadband markets, CLECs need to be able to both offer their services to wide swaths of the broadband market and to do so on a near real-time basis, so as to meet demand for service as it materializes. While many CLECs own and operate their own fiber facilities, typically those facilities allow them to only reach a select number of larger buildings in business districts. The less than ubiquitous footprint of CLEC networks and the relatively long time lags involved in network expansions to new locations necessitates the CLECs' ongoing dependence on the ILECs' loop, collocation and transport facilities.

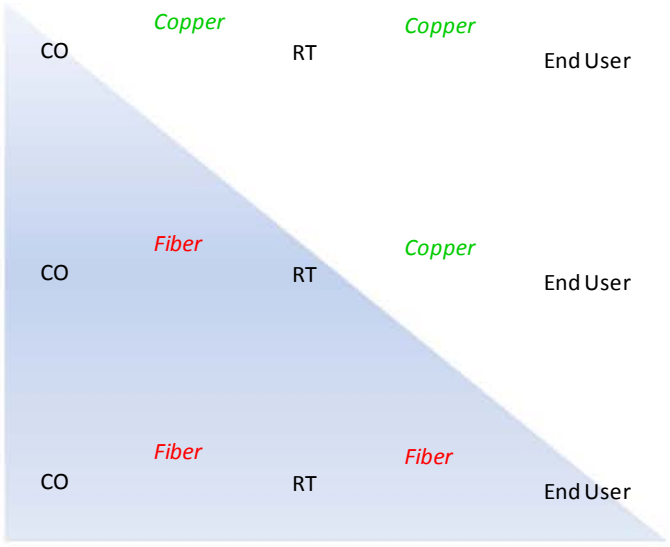
Against the backdrop of CLEC dependence on ILEC facilities, we assessed the CLECs' ability to compete for broadband services by examining the wholesale costs CLECs incur as they lease ILEC facilities (UNEs, collocation, special access circuits, etc.) This analysis takes into account the limited options CLECs presently have for access to ILECs' broadband networks under the broadband policy approach the FCC has pursued to date (see Section II discussion). We look at the cost of leasing local loop and transport facilities for the following three scenarios:

- "Homerun" copper, i.e. the ILEC's loop facilities are provisioned entirely on copper wire pairs from the customer premises back to the serving central office ("CO");
- Various combinations of fiber feeder/copper terminus, including traditional IDLC systems and more advanced deployments such as AT&T's U-verse network; and
- All-fiber loops, e.g. Verizon's FTTx architecture FiOS network

[34] See, e.g. Verizon, Short Term Public Notice of Network Change under FCC Rule 51.333(a), Replacing Copper Feeder Facilities with Fiber Optic Cable and Digital Loop Carrier Systems in Pennysylvania, September 21, 2009, downloaded from http://www22.verizon.com/regulatory/reg_ntw_dscl_html.html (11/12/09); AT&T Short Term Public Notice of Network Change under FCC Rule 51.333(a), ATT20090515S.1 (Copper facility replacement by DLC at Anderson, CA wire center), May 15, 2009, downloaded from http://www.att.com/gen/public-affairs?pid=3137 (11/12/09).

The distinction between these three loop configurations is important because as a result of the FCC's forbearance orders (see Section II), CLECs have lost the ability to lease fiber loops, as well as feeder sub-loops, at cost-based (UNE) rates. The following diagram illustrates this resulting situation, by using blue shading and red font for loop segments to which CLECs no longer have access at UNE (cost-based) rates:

Diminishing Availability of Copper for EOC



To illustrate the impact of the FCC's past policies on the CLECs' ability to compete, our study examines the specific example of the cost of provisioning a 5Mbps Ethernet-based broadband service via the three loop configurations listed above. The 5 Mbps bandwidth assumption is meant to represent a "Mid-band" service aimed at a market segment where CLECs are able to offer reasonably-priced business class guaranteed bandwidth services to business customers over bonded copper loops by utilizing Ethernet-over-copper technology.

Currently available EoC technologies allow the provider to reach speeds of up to 10 Mbps over a single copper pair on short distances and multiple bonded copper pairs as distances increase.[35] In contrast, traditional TDM-based T-1 (DS1) service offers only 1.544Mbps over a 4-wire loop. Of course, there are many situations in which copper is not available, such as greenfield (new build out) situations with all-fiber loops, as well as situations where copper facility has been retired and replaced with a fiber facility (including hybrid loops). Under the FCC's current policy and rules, CLECs do not have the ability to lease lit or dark fiber loops at cost-based (UNE) rates. Therefore, in order to provide broadband service on non-copper loops, CLECs only option (other than building their own facilities, which can be economically

[35] See, for example, http://www.adtran.com/web/page/portal/Adtran/group/445, http://www.actelis.com/products/eadevices.php.

infeasible due to lag times of deploying facilities and/or extremely high capital expenditures) is to lease fiber facilities as an ILEC special access service, i.e. at prices that are not cost-based and that significantly exceed the cost of the analogous UNE products.[36]

Our numerical example – provisioning of a 5 Mbps service over all-copper, hybrid and all-fiber loops – draws on this pricing differential between UNE and special access rates as well as additional network costs. This example also accounts for the fact that ILEC special access (and UNE) tariffs offer services, rather than access to facilities, at specific and discrete speeds (such as DS1 service at 1.544 Mbps and DS3 service at 44.736 Mbps), which do not match the bandwidth of the retail services CLECs need to offer, such as (in our example) 5 Mbps, thus causing excessive breakage and underutilization of facilities.

In this working paper, we look at a sample of five different Metropolitan Statistical Areas ("MSAs"):[37] *Los Angeles, New York, Philadelphia, Phoenix and Washington, D.C*. These five MSAs are important markets for most CLECs and include serving territories of all three RBOCS (AT&T, Verizon and Qwest).

In our calculation of the difference in the cost of leasing facilities to provide 5 Mbps broadband for the three loop types (all copper, all fiber and hybrid) we include only the recurring rates for local loop and local transport circuits. In other words, not included in the results presented below are several types of important cost components: additional leasing costs (i.e., the non-recurring costs for local loop and local transport circuit installations, the recurring and non-recurring cost of collocation in ILEC central offices, the cost of cross-connects, etc.) and other costs directly incurred by the CLEC (including the cost of the CLECs' electronics and other equipment, the costs of installation, maintenance and other network operations, long-haul transport and IP network costs, and retail related costs, such as sales, general and administrative costs). Given these considerations, the costs we present can be considered conservatively low to a significant degree.

The table below provides detailed results by MSA, with the cost presented as ranges between the lowest rate and the highest rate zones:[38]

[36] See United States Government Accountability Office, Report to the Chairman, Committee on Government Reform, House of Representatives, *Telecommunications: FCC Needs to Improve Its Ability to Monitor and Determine the Extent of Competition in Dedicated Access Services*, November 2006. ("*GAO Report*") on Special Access pricing.

[37] Special access pricing varies by MSAs.

[38] Many UNE and special access rates vary by rate zone or band. UNE zones do not match special access zones.

CLEC Cost of Leasing Local Facilities to Provide 5 Mbps Broadband in Selected Metropolitan Statistical Areas*

Monthly Recurring Cost of Local Loop and Transport

ALL-COPPER LOOP										
Cost-based and Available in TRRO-Impaired Wire Centers	2-wire UNE Loops, DS3 UNE Transport	$ 31.08	$ 64.98	$ 35.37	$ 50.99	$ 36.80	$ 68.04	$ 27.47	$ 82.25	$ 36.95	$ 36.95
Available in TRRO-Non-Impaired Wire Centers	2-wire UNE Loops, DS3 Sp A Transport	$ 32.61	$ 68.47	$ 64.85	$ 80.47	$ 62.99	$ 94.23	$ 47.01	$101.79	$ 66.43	$ 66.43
ALL-FIBER LOOPS										
Available in All Wire Centers	Sp A DS1 Local Channels, Sp A DS3 Transport	$463.65	$545.61	$580.81	$743.92	$640.45	$743.93	$548.91	$628.91	$640.45	$743.93
Cost-based but Not Available**	Fractional DS3 UNE Loop, DS3 or OC-3 UNE Transport	$ 64.58	$166.69	$115.28	$115.28	$ 66.31	$ 66.31	$ 91.98	$113.63	$ 84.63	$ 84.63
HYBRID FIBER/COPPER LOOPS* **										
Available in TRRO-Impaired Wire Centers	DS1 UNE Loops, DS3 UNE Transport	$206.80	$423.16	$351.65	$537.53	$294.86	$549.30	$278.93	$313.61	$310.57	$310.57
Available in TRRO-Non-Impaired Wire Centers	Sp A DS1 Local Channels, Sp A DS3 Transport	$463.65	$545.61	$580.81	$743.92	$640.45	$743.93	$548.91	$628.91	$640.45	$743.93

** -- Local Loop and Interoffice Transport rates assuming 10-mile transport. Excludes the cost of cross-connect, collocation and non-recurring cost. Excludes CLEC-own cost, such as the cost of additional electronics, installation, cost of the overlaying Internet service, sales, general and administrative. Special Access rates are collected from the ILEC federal access tariffs based on a 36-months term plans. "Lowest" and "Highest" denote lowest and highest rate zones.*

*** -- Cost based scenario for fiber loops assumes that unbundled OC-3 transport and fractional (bit-rate unbundled) DS3 are available. OC-3 unbundled transport rates are taken from the ILEC UNE tariffs/price lists at the time of TRRO (which removed this service from the list of UNE elements).*

**** -- A third method of provisioning on hybrid loops (not captured here) is a method that requires the CLEC to collocate at remote terminals (points where the copper distribution portion of the loop ends, and the fiber feeder portion of the loop begins). Because of the additional (often uncertain / "Individual Case Basis") cost of remote collocation, this scenario is generally not economically feasible.*

At shown in the table, CLECs' costs of leasing all-copper facilities vary from $27.47 to $82.25 per month in "TRRO impaired" wire centers (wire centers where high-capacity transport services are available at UNE rates), and from $32.61 to $101.79 per month in "TRRO non-impaired" wire centers (wire centers where high-capacity transport services are not available at UNE rates). CLECs' current cost of leasing all-fiber facilities necessary in order to provide 5Mbps broadband service are significantly higher than the costs for all-copper loops and vary from $463.65 to $743.93 per month. In contrast, the underlying cost of ILEC all-fiber facilities (as measured by the cost to provide 5Mbps of bandwidth over a DS3 UNE loop) are much lower and range between $64.58 and $166.69. Finally, CLECs' current cost of leasing hybrid loops in order to provide broadband service are also high and range between $206.80 and $549.30 in TRRO impaired wire centers, and between $463.65 and $743.93 in TRRO non-impaired wire centers.

The Table below provides a summary of the MSA-specific findings by presenting an aggregate average of "lowest" and "highest" cost (averaged over the five MSAs):

CLEC Cost of Leasing Local Facilities to Provide 5 Mbps Broadband*

Monthly Recurring Cost of Local Loop and Transport

ALL-COPPER LOOP					
Cost-based and Available in TRRO-Impaired Wire Centers	2-wire UNE Loops, DS3 UNE Transport	$	33.53	$	60.64
Available in TRRO-Non-Impaired Wire Centers	2-wire UNE Loops, DS3 Sp A Transport	$	54.78	$	82.28
ALL-FIBER LOOPS					
Available in All Wire Centers	Sp A DS1 Local Channels, Sp A DS3 Transport	$	574.85	$	681.26
Cost-based but Not Available***	Fractional DS3 UNE Loop, DS3 or OC-3 UNE Transport	$	84.56	$	109.31
HYBRID FIBER/COPPER LOOPS****					
Available in TRRO-Impaired Wire Centers	DS1 UNE Loops, DS3 UNE Transport	$	288.56	$	426.83
Available in TRRO-Non-Impaired Wire Centers	Sp A DS1 Local Channels, Sp A DS3 Transport	$	574.85	$	681.26

** -- Local Loop and Interoffice Transport rates assuming 10-mile transport. Excludes the cost of cross-connect, collocation and non-recurring cost. Excludes CLEC-own cost, such as the cost of additional electronics, installation, cost of the overlaying Internet service, sales, general and administrative. Special Access rates are collected from the ILEC federal access tariffs based on a 36-months term plans. "Lowest" and "Highest" denote lowest and highest rate zones.*

*** -- Five MSAs include Los Angeles, CA, New York, NY, Philadelphia, PA, Phoenix, AZ and Washington, D.C.*

**** -- Cost based scenario for fiber loops assumes that unbundled OC-3 transport and fractional (bit-rate unbundled) DS3 are available. OC-3 unbundled transport rates are taken from the ILEC UNE tariffs/price lists at the time of TRRO (which removed this service from the list of UNE elements).*

***** -- A third method of provisioning on hybrid loops (not captured here) is a method that requires the CLEC to collocate at remote terminals (points where the copper distribution portion of the loop ends, and the fiber feeder portion of the loop begins). Because of the additional (often uncertain / "Individual Case Basis") cost of remote collocation, this scenario is generally not economically feasible.*

Again, this table shows that the CLEC cost of leasing all-fiber or hybrid loops ($574.85 to $681.26 per month) as a means of providing 5 Mbps broadband service are higher, by an order of magnitude, than the cost of leasing copper loops ($33.53 to $60.64 per month) that deliver the same speeds. Given that the market price of the retail broadband product such as the 5 Mbps Ethernet product is typically in the range of $600-$800 per month, and as discussed above, this cost analysis does not include numerous

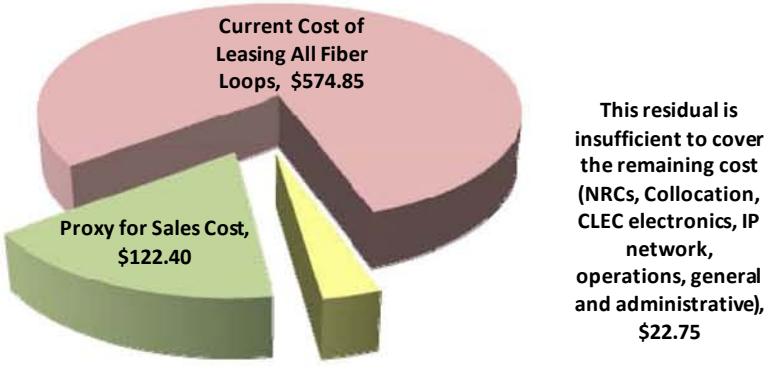
other cost components (such as NRCs, the cost of collocation and CLECs own operations), it follows that CLECs cannot economically offer broadband retail products under currently available special access rates. It is also important to observe that the ILECs' underlying costs to provide all-fiber facilities that could support the 5 Mbps service ($84.56 to $109.31) are significantly lower than the special access rates.

The following example shows that the CLECs face a situation of a classical price squeeze, in which the costs of essential inputs to their retail service are so high relative to the prevailing retail price level that they could not generate a reasonable profit. [39] It assumes that the retail rate of a 5 Mbps broadband offering is $720.[40] It also assumes that 17% of this end-user rate is the cost of sales or retail (an assumption that utilizes the retail discount rate typical in the industry (17%)). The remaining retail rate net of retail cost is $597.60. As shown in table above, the CLEC cost of leasing all-fiber or hybrid loops are on average between $574.85 to $681.26 per month, depending on the applicable special access zone. It follows that CLECs cannot cover their lease costs in the highest rate zone because $681.26 is greater than the retail rate net of retail cost of $597.60. In the lowest cost zone the difference between retail rate net of retail cost ($597.60) and the lease cost ($574.85) is only $22.75, which is also insufficient to cover all of the other costs faced by a CLEC providing the 5 Mbps Ethernet service, including its directly-incurred costs as well as additional leasing costs, as we enumerated above (see page 15). This last observation is depicted in the following chart:

Example of Price Squeeze in All-Fiber Loop Scenario in the Lowest-Cost Zone

Retail Rate for 5 Mbps Service: $720/month

Cost of Leasing Fiber: Average of Lowest Zone Rates in 5 MSAs



[39] See, e.g., the *Triennial Review Remand Order*, at para. 59, footnote 159, observing that "an incumbent LEC might effect a price squeeze by raising the price for the special access service (or other wholesale tariffed offering) to a level that precludes the wholesale customer from using that service to provide service in the retail telecommunications market at a price comparable to that charged by the incumbent or other market participants."

[40] This is the rate offered by Speakeasy (http://www.speakeasy.net/business/ethernet/) for 5 Mbps Ethernet service that includes 100 free e-mail accounts, Static IP and free installation and hardware.

IV. CONCLUSION

We view the particular results supplied above as preliminary, as we intend to expand our analysis to encompass all of the relevant costs that have not yet been specified, consider in more detail the impacts of cost drivers such as distance and density, and address a wider range of service offerings and geographic markets. Nevertheless, the fact that we have identified a substantial price squeeze consistently across all of the scenarios we examined, even before all relevant costs have been explicitly factored in, leads us to conclude that it is likely to be a robust phenomenon. Consequently, our analysis corroborates a central thesis of the Berkman Report – namely, that open access policies can play a crucial role in advancing the evolution of a nation's broadband infrastructure – by shedding light on the root causes of the United States' decline in relative broadband performance relative to other nations. Specifically, our analysis illustrates how the FCC's historical retreat from an open access broadband policy, via its forbearance orders and related decisions, has impeded the ability of CLECs to participate in broadband markets not just by limiting the availability of essential facilities but also raising their costs to prohibitive levels. In light of these findings, we conclude that the FCC should reexamine its "closed" broadband policies relative to the ILEC networks, and consider taking affirmative steps to reinvigorate competitive provision of broadband services by CLECs. Two of the most important steps would include: (1) guaranteeing continued competitive access to the ILECs' legacy copper networks and (2) expanding CLEC opportunities for access to include portions of the ILECs' emerging fiber-based broadband networks. Incorporating these actions into the National Broadband Plan could begin the process of reversing the nation's broadband performance trajectory and move forward towards the goal of bringing affordable, high-quality broadband services to all Americans.